RESEARCH HIGHLIGHT

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FIELD TESTING OF "SPILLAGE-RESISTANT" APPLIANCES

INTRODUCTION

Chimneys are an endangered species in new Canadian houses. The combination of improved house airtightness and higher capacity exhaust appliances is increasing the extent of house depressurization. Chimneys have problems maintaining draft under high levels of house depressurization. At low levels of depressurization such as 5 Pascals (Pa), the chimney will backdraft (or move air into the house) during the off-cycle. This can also happen when an appliance, such as a wood fireplace, is cooling down. At high levels of depressurization, for instance 30 Pa, even a hot operating chimney can be turned around and will spill combustion gases into the house. No matter what heating fuel is used—natural gas, oil or wood—this is not a good situation.

Manufacturers of furnaces, hot water heaters, fireplaces and other combustion appliances have created devices that are far more resistant to spillage than those with a chimney. The manufacturers do not usually certify their appliances as being capable to operate under high depressurization (except in Minnesota—see sidebar), but the designs are inherently more spillage resistant. The devices have a de facto recognition as being applicable in exceptionally airtight houses, such as R2000, or with exhaust-only ventilation systems (for example, 1993 et al Ontario Building Code). Earlier research by the gas utilities and CMHC (Sheltair 1990) show that many of these appliances should be able to resist levels of depressurization higher than 5 Pa, but that manufacturing defects or installation deficiencies could make them vulnerable.

This research was undertaken to see whether "spillage-resistant" appliances, as found in the field, could resist house depressurization up to 50 Pa.

RESEARCH PROGRAM

Over 100 appliances were tested in the area of Peterborough, Ontario. The contractor was conducting building energy assessments and, with the homeowner's consent, also tested spillage-resistant appliances located in the house. The appliances had to fall into the following categories: high-efficiency gas furnaces, power-vented gas hot water heaters, sealed combustion or direct vent gas fireplaces, and sidewall-vented oil appliances.

The appliances were tested while the house was depressurized to 50 Pa by a blower door. Quantification of the spillage was rudimentary. The contractor rated the appliances as having no, slight, medium, or high spillage. Spillage that could not be detected with a naked hand but could be observed with a smoke pencil was labelled slight. It corresponds roughly to the 2 per cent spillage limit that is permitted by gas appliance standards. Medium spillage could be detected without a smoke pencil. "High" spillage—described as obvious and excessive—was rarely seen in the survey. The devices were tested both prior to and during operation. Differences in the test results for the two conditions were minimal.

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RESEARCH RESULTS

The results are divided by type of appliance. All "spillage-resistant" appliance types showed significant spillage in the field. Power-vented gas hot water heaters were perhaps the most consistent with only one notation of "medium" spillage in the 17 tested, and the highest percentage with no indicated spillage. Gas fireplaces were often leaky, particularly around the blowout panels. The small sample size precludes comparing the relative performance of different appliance makes or models.

	gas furnace	gas DHW	gas fireplace	oil furnace	oil DHW
number tested	61	17	14	8	1
no spillage	15	7	1	0	0
slight spillage	34	9	7	5	1
medium spillage	12	1	6	3	0

IMPLICATIONS FOR INDUSTRY

Housing industry and gas appliance manufacturers are counting on "spillage-resistant" appliances to keep householders safe in houses with high potential depressurization. The survey results show that there are significant problems with this strategy. All types of appliances could and did leak under 50 Pa depressurization. It is likely that appliance test standards will have to develop and build in depressurization testing as part of certification, so that diligent design and assembly that does not spill can be recognized and labelled. For the moment, it would be advisable to install carbon monoxide sensors in the vicinity of the appliances to alert householders to the most dangerous spillage events.

MINNESOTA BUILDING CODE

Recent Minnesota state building code requires spillage-resistant appliances for specific house designs. The appliances have to be able to safely operate in a 50 Pa house depressurization. The State is counting on manufacturers to publicly identify the products suitable for these environments, with all the liability that entails. Manufacturers use their own testing results to verify whether appliances can handle these conditions. Approved appliances are listed on a Web site:

http://www.state.mn.us/cgi-bin/portal/mn/jsp/content.do?contentid=536894726&contenttype=EDITORIAL&agency=NorthStar

None of the appliances with significant spillage ("medium" or "high") was listed on the Minnesota Web site. This may substantiate to some degree the validity of the claims made there by manufacturers. However, differences in the Canadian and American markets means that some manufacturers represented in the Peterborough survey do not sell in Minnesota, or that the model names and numbers used in Minnesota may not apply to appliances sold in Canada.

REFERENCES:

Sheltair Scientific. House Depressurization Tolerance of Mid-efficiency Gas Furnaces. Report to CMHC, 1990.

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Housing Research at CMHC

Under Part IX of the *National Housing Act*, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

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